

With the increased facilities for distribution which rural free delivery of mails is bringing about, a new field of usefulness is being opened to the forecaster. In order to cover this field, he will have to acquire information hitherto unnecessary concerning the different branches of agricultural industry.

Among the items that would be of great value to farmers would be a knowledge, twenty-four to thirty-six hours in advance, of the moisture conditions of the atmosphere irrespective of precipitation; that is to say, the relative humidity. Such a knowledge might in many instances be of more service than a knowledge of the possibility of rain. The moist condition could be predicted with certainty over large areas, while rainfall might be restricted to small and widely scattered localities. This kind of forecasting would of course be most useful in sections where agriculture is most practised, such as the Mississippi, Ohio, and lower Missouri valleys, and where road improvement will advance so as to make rural free delivery possible, without which this class of forecasting would be practically useless. Of course many problems present themselves in distribution of forecasts by this method.

Agricultural instruction is spreading throughout the region referred to by means of the agricultural press and the Government experiment stations. Many thousands of farmers are already well informed concerning the various relations of soil, air, sunshine, and rainfall to agricultural operations. Many a farmer knows that it is not the best time to cut hay when there is a south or southeast wind, even when the sky is clear and there is little prospect of rain; for by practical observation he has learned that the drying process will often be so slow that the rainy conditions may overtake him before the hay will be fit to put in stack or barn, and that having been even wilted the hay is much more susceptible to injury from rain. He has learned, too, from the school of experience that he can cut hay just before a hard rain of considerable duration; provided that the rain is followed by a considerable period of dry northwest wind and clear sky, and that he has the improved implements necessary to handle hay in that condition. Many a time the only thing that he lacks, to enable him to make use of a threatening day, is to know the probable drying conditions for thirty-six hours following. If this were known he could often go out between showers on a cloudy and showery day, when the hay would not wilt much, and do cutting that would otherwise consume valuable time. Then, again, if the farmer could have some assurance of continuous drying conditions for a considerable time, he would venture upon wholesale methods in haying. Much that has been said about haying will apply with equal force to the grain and corn fodder harvest.

While drying weather is not hoped for during harvest time, the reverse is true at any subsequent time when it becomes necessary to move fodder or hay from place to place. On a dry day the leaves, which are the most nutritious and palatable part of the plant, are badly shattered and lost. Clover hay will sometimes lose so much in this way as to become nearly worthless as a fodder for sheep and of much decreased value for other animals. It is even better to shred or chop the hay or fodder on a damp day, and then overcome the heating tendency which it develops when stored in large bulk by alternating layers of straw with the cut fodder to absorb the moisture, rather than to run the risk of loss on a dry day. This principle will not hold good in baling hay or shredded fodder, for in this case heating and mildewing will frequently result if the work is done on a damp day.

As all of these operations require planning and arranging by the farmer for several days ahead, it is very evident that a foreknowledge of the moisture conditions of the air would be very helpful. Most any experienced farmer, by reason of

his years of observation, can predict the more prominent features of the weather with fair certainty. He knows, for example, that in his locality a steady southeast wind is damp and that a steady northwest wind is dry, but he can not always tell thirty-six hours in advance from which direction the wind will blow; neither does he know of the drying power nor the duration of an area of high barometer, with its calms and variable winds. It is within the power of the forecaster to transmit this information.

The general forecasts as now issued frequently contain information of the wind direction, and should do so always; but since this does not carry with it the whole story of moisture conditions, and since there are many people directly concerned who do not fully understand the moist and dry attributes of wind from different directions, much amplification would result from the addition of such terms as "more moisture," "less moisture," "moisture stationary," or something similar.

Only a few instances of the usefulness of this kind of forecasting have been cited, but they show that there is a demand for such work. Doubtless tobacco curers, raisin growers, many manufacturers and others would be benefited.

THUNDERSTORMS NEAR WASHINGTON.¹

By Messrs. H. W. and H. S. CRAGIN.

Mr. H. W. Cragin writes as follows:

"August 6.—The season has been very dry. From my observation I do not think the showers passing over the Blue Ridge go far to the east or northeast. Sometimes I see showers far to the north or northwest, which seem to reach the ridge. We can not see the east or northeast unless we go to the top of Stony Man Mountain, about 500 feet above our camp and about a mile northeast of it. This peak is supposed to be 90 miles in an air line from the Washington Monument, which it is said has been seen when the air is very clear by the aid of a powerful glass. To the west our view is unobstructed as far as the eye can reach. Most of the showers observed form west of the Massanutton Range, which separates Page Valley on the east from the Shenan-

¹In the MONTHLY WEATHER REVIEW for 1898, pages Nos. 256, 317, 360, and 465, the Editor has considered the difficulty of making predictions of the arrival of local storms at the City of Washington, even a few hours in advance, owing to the want of a sufficiently close network of telegraph and telephone stations. The most obvious remedy for this defect is the establishment of stations on elevated points, such that each observer may command a satisfactory view of the occurrence of storms within a radius of 20 miles. Although a few such stations would seem to command the situation satisfactorily, yet, they would be expensive because the whole time of the observer would, necessarily, have to be devoted to the careful observation of all visible thunderclouds. On the other hand, by utilizing the operators at telegraph and telephone stations we should ask for only a minute of time in order that each may send to the Central Office word that the first thunder is heard, or the first rain has fallen. The study of local storms in the United States always impresses one with a realization of the sparsity of inhabitants in this country as compared with Europe. We can rarely find an observer for every 50 square miles in the regions where they are most wanted.

Under these conditions an especial interest must attach to such detailed reports of thunderstorms and weather as we have received from Mr. H. W. Cragin and his son, Mr. H. S. Cragin, residents of Washington, D. C., who send us a very full report from their summer residence near Skyland, Page County, Va. The camp occupied by them is about ninety miles in a straight line from the Washington Monument, which it is said, has been seen by some from that place. The camp is about 500 feet below and a mile southwest of the top of Stony Man Mountain, the altitude of whose summit is 4,032 feet, according to the United States Geological Survey. It is 12 miles east of New Market Gap in the Massanutton Range, which is often referred to as "The gap." The details of the observations made at this place during July and August will have special interest in connection with the great area of high pressure and long-continued drought, with cloudless skies, that has prevailed throughout the Middle and South Atlantic States.—Ed.

doah Valley on the west. Luray is about eight miles west of us. The temperature here during the hot wave is from 12° to 14° lower than at Washington. Stony Man Mountain is about as high as any elevation of the Ridge, excepting Roan Mountain, N. C., if I am correctly informed."

"August 10.—The season is remarkably dry, and we are somewhat in fear that all but one of our springs will fail us. Since the very light precipitation of the 29th ultimo we have had nothing. During this hot wave the humidity here seems small. Next year I hope to have a barometer, wind and rain gage. I think there is much here in ordinary seasons to interest an observer. The Alleghenies are in the range of vision to the west, and any change in the lower Lake region or the Ohio Valley quickly reaches here. The down draft of an eastern current of air into the Page Valley, which often begins about 6 p. m., interests me. I have thought it to be usually caused by the rising of the hot air in the valley, which would naturally draw down the cooler air under it, but I do not think the latter (east current) reaches far into the valley, but shall inquire. When rain comes from the east it is usually accompanied by mist, and sometimes lasts for three days. We have had no storm from that direction since June 15 to 20, which is quite unusual. The apple crop to the west of the ridge is said to be small; to the east conditions are better. The chestnut yield will be a failure. I notice that the foliage of all varieties of trees is not as thick as last year on the ridge. There is not that difference in the minimums of temperature between this place and Washington that I should expect between midnight and 6 a. m. During warm waves I sometimes notice a warm current of air coming over from the east side of the ridge before the sun rises. We shall take pleasure in sending a report for August."

DAILY RECORD BY MR. H. S. CRAGIN.

Stony Man Peak, in the immediate vicinity of this camp, is supposed to be 4,032 feet above sea level, and the camp is said to be somewhat over 3,500. New Market Gap is almost directly west of here, and it is in the neighborhood of this place that most of the storms develop. They generally form to the west or northwest of the gap, sometimes as far as the North Mountain, and drift in a northeasterly direction down the Shenandoah Valley. If the shower starts in the gap to the south of it, it is likely to move easterly and pass over this camp. I am sorry to say that I am not able to make any observations to the east of the ridge, as that section of the country is completely hidden from view. Apparently the only showers that do occur to the east cross over from the west. It is a very rare thing for a storm to start either in or to the east of the mountains. Sometimes, though seldom, a storm starts in these mountains far to the south of here and drifts easterly. The storms that I spoke of as moving down the Shenandoah Valley sometimes cross the Blue Ridge 20 miles or more to the north of here.

I make all these observations from the camp, and, as the showers are very deceptive in their movements, I fear that this report is not as accurate as I would like it to be.

July 1.—8 a. m., 50°; 2 p. m., 67°; 8 p. m., 60°. Fair; fresh northwest winds, diminishing at night.

July 2.—8 a. m., 60°; 4 p. m., 70°; 8 p. m., 63°. Fair; fresh southwest, shifting at 4 p. m. to east, and becoming fresh during the night. It grew warmer during the night.

July 3.—8 a. m., 72°; 4 p. m., 81°; 8 p. m., 72°. Partly cloudy; fresh southwest winds. A belt of light showers developed about 1 p. m. to the west of camp and drifted across Stony Man Ridge toward the northeast.

July 4.—8 a. m., 72°; 4 p. m., 82°; 8 p. m., 72°. Fair; fresh southwest wind. A shower, with but little thunder, between 1 and 2 p. m.; it formed 3 or 4 miles to the north of

the gap (New Market Gap, which is about 12 miles west of camp) and moved off east crossing our ridge to the north of camp.

July 5.—8 a. m., 71°; 3 p. m., 83°; 10 p. m., 73°. Between 4 and 5 p. m., a shower formed in the Shenandoah Valley, extending several miles to the north and south of the gap. Between 8 and 9 p. m. another shower had developed to the south of the gap. Both of these dissipated almost where they formed.

July 6.—8 a. m., 70°; 4 p. m., 83°; 12 p. m., 71°. Fair, with fresh southwest winds. About 7 p. m., a belt of dark clouds formed far to the west and extended far to the north of camp. During the night west winds increased and the hot wave was somewhat broken.

July 7.——; —; —. Partly cloudy; fresh west winds. About 12 a. m. (noon?) a shower formed to the south of camp and moved eastward.

July 8.—8 a. m., 68°; 1 p. m., 76°; 9 p. m., 68°. Partly cloudy, with high west winds. About 1 p. m. a shower without thunder formed 2 miles to the north of camp and moved east. During the night the hot wave was broken.

July 9.—9 a. m., 58°; 3 p. m., 66°; 11 p. m., 56°. Partly cloudy; high northwest wind.

July 10.—8 a. m., 56°; 3 p. m., 70°; 8 p. m., 56°. Fair; light northwest, shifting to east, winds at night.

July 11.—8 a. m., 70°; 2 p. m., 79°; 8 p. m., 70°. Fair; southwest, shifting to east, winds at night.

July 12.—8 a. m., 68°; 3 p. m., 77°; 8 p. m., 64°. Partly cloudy, with showers in the afternoon; brisk southwest winds. Between 2 and 3 p. m. a belt of showers formed to the north of the gap. Between 3 and 4 p. m. these extended 20 miles to the north of the gap. The storms were severe, and they moved east-northeast, crossing our ridge between 4 and 5 p. m.

July 13.—8 a. m., 56°; 3 p. m., 68°; 8 p. m., 60°. Fair; fresh northwest to north winds.

July 14.—8 a. m., 63°; 3 p. m., 72°; 8 p. m., 65°. Fair; southwest winds.

July 15.—8 a. m., 70°; 2 p. m., 82°; 9 p. m., 73°. Fair; light south winds.

July 16.—8 a. m., 74°; 3 p. m., 86°; 10 p. m., 77°. Fair; winds south, shifting to brisk southeast at night.

July 17.—8 a. m., 74°; 3 p. m., 86°; 10 p. m., 76°. Fair and warm, with south, becoming east, winds at night.

July 18.—8 a. m., 72°; 3 p. m., 87°; 8 p. m., 74°. Fair, continued very warm; south winds.

July 19.—8 a. m., 72°; 3 p. m., 81°; 8 p. m., 76°; 9 p. m., 64°. Partly cloudy and not so warm, with showers in the afternoon and night; fresh southwest to west winds. At 2 p. m. a thundershower formed to the west of here in the Shenandoah and moved northeast down that valley. About 5 p. m. a shower formed near Luray and moved down the Page Valley, while at the same time a shower crossed the Blue Ridge to the south of here a few miles, moving in a northeast direction. At 8 p. m. a heavy thundershower formed to the south of the gap, crossed the Page Valley, passed over camp, and disappeared to the east of the ridge about 9 p. m.

July 20.—8 a. m., 69°; 1 p. m., 79°; 8 p. m., 72°. Fair, with moderate temperature and south winds in a. m. During the afternoon and night showers occurred in the Shenandoah Valley to the north and south of the gap, but dissipated without moving.

July 21.—8 a. m., 70°; 2 p. m., 83°; 8 p. m., 78°. Fair and slightly warmer; fresh southwest winds.

July 22.—8 a. m., 64°; 3 p. m., 73°; 8 p. m., 67°. Generally cloudy, with showers and cooler. About 5 a. m. a spiteful shower with but little rain passed over camp. About 8 a. m. a thunderstorm formed near the gap (New Market Gap 12 miles west of camp) and moved northeast down the Page

Valley crossing the Blue Ridge a little to the north of here. Showers occurred about here from 5 till 8 p. m., but could not see them on account of fog.

July 23.—8 a. m., 69°; 2 p. m., 77°; 10 p. m., 62°. Partly cloudy in a. m., with showers in p. m. From 5 till 7 p. m. a succession of ill-defined showers moved down the Shenandoah Valley. Fog obscured many of their movements; east winds prevailed.

July 24.—8 a. m., 66°; 2 p. m., 75°; 8 p. m., 68°. Partly cloudy, with moderate temperature and southeast winds. About 4 p. m. a shower developed to the south-southwest of here and moved north-northeast down the Page Valley. It was a light shower, with no thunder.

July 25.—8 a. m., 70°; 2 p. m., 79°; 8 p. m., 66°. Partly cloudy and slightly warmer, with east winds. It turned cooler at night. About 4 p. m. a shower with some thunder formed to the south of the gap and moved northeast with great rapidity, crossing the ridge immediately to the south of here; the northern edge passed over camp.

July 26.—8 a. m., 62°; 3 p. m., 68°; 8 p. m., 65°. Rain and fog in a. m., fair in p. m.; light south winds.

July 27.—8 a. m., 61°; 3 p. m., 69°; 8 p. m., 65°. Partly

cloudy, with brisk east winds in a. m.; east winds diminished, with fair weather in p. m.

July 28.—8 a. m., 63°; 3 p. m., 73°; 10 p. m., 64°. Fair; north to northeast winds.

July 29.—8 a. m., 64°; 2 p. m., 71°; 10 p. m., 64°. Fair in morning. Increasing cloudiness, with rising southeast winds in p. m. Light rain fell in the night.

July 30.—8 a. m., 64°; 3 p. m., 78°; 8 p. m., 68°. Cloudy in early morning, clear during the day; southwest winds prevailed, with slightly warmer weather. About 4 p. m. a shower formed to the north of the gap and passed southeast over camp, after which it dissipated.

July 31.—8 a. m., 68°; 3 p. m., 81°; 8 p. m., 69°. Partly cloudy and quite warm, with fresh southwest winds.

The gap spoken of is New Market Gap, 12 or more miles west of this place. Since June 16 the lightning has struck three times at this place, within an area of 100 acres, seemingly attracted by the wire fencing. The drought in the Page Valley was broken on July 19, but rain is very much needed now in this region. The general trend of thunder-showers is down the Shenandoah Valley, or northeastward toward of Riverton.

NOTES BY THE EDITOR.

ELECTRIC PHENOMENA IN THE EUPHRATES VALLEY.

On page 286 we publish an interesting letter from Mr. Ellsworth Huntington relative to lightning flashes passing between several of the mountain peaks bordering the wild gorge of the Euphrates 20 or 30 miles south of Harpoot (Charput). The Editor has endeavored to find a satisfactory map of this gorge, on which to locate the peaks referred to by Mr. Huntington, but the best that he has access to fails to mention them. He has, therefore, published with Mr. Huntington's article a copy of a portion of Kiepert's map of Asia Minor as reprinted in Petermann's Mitteilungen, Ergänzungsband 4, 1867, the latest edition of this map being inaccessible to him. On this map (see page 286) the reader will perceive the gorge or canyon, that extends, with many rapids and falls, for 40 miles above Telek and 20 miles below that place. The locations of Mr. Huntington's peaks and of other points given on his sketch have been transferred to this map as well as we were able to do. On either side of the gorge the country is an elevated plateau, 5,000 feet above sea level. The peaks numbered and named by Mr. Huntington are undoubtedly the remnants of the harder rocks left by the river as it cuts its channel deeper and deeper. The Lake Geuljik is believed to have an underground outlet and to be the head water of the great spring north of Telek, at which the river Tigris begins.

We need not apologize for refraining from attempting to find the correct explanation of the mysterious lightnings and thunders here recorded. It is well known that lightning passes between cloud and cloud or cloud and earth, but we have not yet any well authenticated case of its passing from peak to peak, although the poets describe it as "leaping from crag to crag." Byron is quite true to nature when he (in *Childe Harold*, Canto III, stanza 92), describing a thunderstorm on Lake Leman, says:

Far along
From peak to peak, the rattling crags among,
Leaps the live thunder.

There are peaks in the Rocky Mountains on which almost continuous electric discharges have been observed, but they pass off into the air quietly, like St. Elmo's fire, never in great flashes from peak to peak. During eruptions of

Vesuvius, the lightning passes from the mountain to the clouds of steam that have risen from the volcano, but not between neighboring peaks. In general, the air ordinarily offers such a resistance to the passage of electricity, while the earth is such a good conductor of electricity, that it would be easier for two electrified peaks to discharge through the earth than through the air. We can not, therefore, think of a lightning flash passing between two neighboring peaks. On the other hand, a cloud or a mass of electrified air that has not quite attained the cloudy condition may lie between two peaks, and flashes may proceed from it simultaneously to the two peaks in such a way as to lead a careless observer to say that one peak discharged over to the other. If this is the approximate explanation of the Euphrates phenomenon, then it will happen only when the wind is in certain directions, such as to cause the formation of an incipient cloud and thunderstorm between the two peaks, and this wind direction will depend upon the relation of the peaks to the course of the river valley below. But when we remember how easily myths spread and become common property, so that the same error is believed by everyone, generation after generation, until some scientific investigator probes it to the bottom and dispels the illusion; when we remember that Asia Minor has been the nursery for all the myths and wonders and miracles that fill the literature of Arabia, Greece, Rome, and modern Europe; when we remember that Mr. Huntington has not seen this phenomenon, but describes it on the authority of numerous credible natives, who state that it was seen by others years ago, we must be allowed to express the wish that he will continue his researches in that neighborhood until he has seen it and can describe it from personal experience. If it is a thunderstorm phenomenon, it can not be so very rare; but if it is a myth, based upon some historical event or some misinterpretation of ancient names, the explanation will be most interesting to students of history and philology.

NOTABLE LIGHTNING.

In connection with the preceding note Mr. Heiskell, of the Weather Bureau, sends the following description of two interesting cases of lightning: